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ABSTRACT

Twenty-seven seventh-grade students participated in a study designed to investigate the student rate of progress through the computer-assisted instruction (CAI) text in relation to ability and achievement. Measures were developed to determine the general reading rate for each individual and to notice any deviation from that rate. It was found that word rate and word rate stability as measures of reading behavior predict science achievement with greater efficiency than the Metropolitan Achievement Test (MAT) for reading. The word rate measure also appears to have more predictive power than latency. Appendices contain statistical data collected by the study and a reference list. (JY)

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CAI WORD RATE - STUDENT ABILITY AS PREDICTORS OF ACHIEVEMENT

TECHNICAL REPORT 2

ISCS

SUPPORTED BY USOE CONTRACT OEC 2-6-061762-1745 AND NSF GRANT GW-4235

THE FLORIDA STATE UNIVERSITY

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TECHNICAL REPORT II
CAI WORD RATE - STUDENT ABILITY AS PREDICTORS OF ACHIEVEMENT

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JULY 20
1970

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INTERMEDIATE SCIENCE CURRICULUM STUDY
DEPARTMENT OF SCIENCE EDUCATION
FLORIDA STATE UNIVERSITY
TALLAHASSEE, FLORIDA

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FOREWORD

The ISCS Technical Report Series is intended to provide communication to other colleagues and interested professionals who are actively interested in research with and development of curriculum material. The rationale for the Technical Report series is three-fold. First, to report in a concise, descriptive, and explanatory nature advances made in the technology of curriculum development. Second, to give quick distribution to pilot studies that show great promise with potential for further research and subsequent reporting. Third, to provide for distribution of pre-publication copies of implementation studies that, after proper technical review, will ultimately be found in professional journals.

This report suggests a promising new way to monitor student progress through printed curriculum material with implications for the evaluation of students in terms of achievement. The word-rate measure reported also has potential for researchers interested in investigating the reading behavior of students.

Ernest Burkman, Director
Intermediate Science Curriculum Study

July 20, 1970
The Florida State University
Tallahassee, Florida

GENERAL BACKGROUND ON THE INTERMEDIATE SCIENCE CURRICULUM STUDY

The Intermediate Science Curriculum Study (ISCS) is a large-scale instructional research project supported to date by a contract with the United States Office of Education and grants from the National Science Foundation. The project is designed to develop, test, and disseminate into practice a system of individualized science instruction for grades seven through nine.

The project is organized on a develop-field-test-revise design. Draft materials are produced at Florida State University by on- and invited off- campus personnel and tested on a large national sample of junior-high-school students. During the 1969-70 school year, more than 75,000 students in 25 states are involved in the field testing of the ISCS materials. In addition, a small number of students from the Florida State University campus school are taking a computer-assisted instruction version of the materials from which additional feedback data are being accumulated. To date, more than 400 scientists, teachers, and education specialists have cooperated in the development process.

The most unique feature of the ISCS materials is the fact that the students using them progress at different rates and through different instructional pathways depending upon their interests, abilities, and previous experiences. The materials are being designed that this can be accomplished in ordinary science classrooms by teachers with limited special training.

The package of instructional materials for each grade level consists of student printed materials, specially designed laboratory apparatus, a student self-evaluation system based upon behavioral objectives established for the instructional materials, teacher orientation materials, and standardized tests. The Silver Burdett Corporation, in conjunction with Damon Educational Corporation, is distributing these materials during the experimental phase of the project and will market the commercial version of them.

The project has generated world-wide interest; and its newsletter, published twice yearly, now goes to more than 10,000 people in 42 countries. ISCS materials are now in use in Australia and will be used in American dependent schools in Germany and Japan in September. Experimental testing of the materials is now underway in Manila, and plans have been established for a joint Florida State University - Philippines effort to produce a special Philippines version of the program. In addition, project personnel have visited Japan, India, and several South American countries for preliminary discussions related to possible use of the materials in these areas.

TABLE OF CONTENTS

FOREWORD iii

GENERAL BACKGROUND ON THE INTERMEDIATE SCIENCE CURRICULUM STUDY iv

LIST OF TABLES vi

CAI WORD RATE - STUDENT ABILITY AS PREDICTORS OF ACHIEVEMENT 1
- Introduction 1
- Background Information 1
- Purpose 3
- Procedure 4
- Results and Discussion 6

SUMMARY 12

APPENDIX A
- Data Listing for Eleven Variables

APPENDIX B
- Data Listing for Twenty-Six Variables on 10 CAI Students

APPENDIX C
- Spearman Rank-Order Correlation Matrix of Intelligence, Ability, and Achievement Variables with CAI Variables by Chapter

APPENDIX D
- References

LIST OF TABLES

TABLE	TITLE	PAGE
I	Characteristics of the ISCS-CAI Student Group	4
II	Descriptive Statistics of the Ten CAI Student Sample	5
III	Spearman Rank Inter-correlations of Achievement, Ability, and CAI Variables	8
IV	Correlations of Word Rate and Word Rate Stability with ISCS Achievement by Chapter	10
V	Summary Table - Multiple Regression Analysis Using Word Rate	11
VI	Summary Table - Multiple Regression Analysis Using Word Rate Stability	11

CAI WORD RATE - STUDENT ABILITY AS PREDICTORS OF ACHIEVEMENT

Introduction

In the fall of 1966, the Intermediate Science Curriculum Study (ISCS) began a large scale curriculum effort in which Computer Assisted Instruction (CAI) was envisioned as an economically defensible and uniquely valuable research and development tool for use by the curriculum developer. The application of CAI held promise as an appropriate and effective means of monitoring in detail individual student progress and performance in laboratory-centered, self-pacing printed student materials. Two and one-half grade levels of ISCS science materials have been programmed for CAI presentation on an IBM 1500 system. ISCS Technical Report (Teates, et al., 1970) describes the ways in which CAI information has been programmed and analyzed. This report is concerned with the student rate of progress through the CAI text in relation to ability and achievement.

Background Information

In the final analysis, the two viable learner resources most readily available to the curriculum developer are student ability and student time. Because of the availability of latency and student-response information, CAI provides a straight-forward means of examining, for any student, the time spent on any frame of material as well as his achievement on that frame. Correct responding is an obvious variable that has a high probability of predicting successful terminal performance. Latency, on the other hand, is a less well understood, though often measured, learning variable. Latency is defined as the interval between the presentation of a unit of instruction to the learner and the learner's response to the unit. The unit may be composed of information or a question which calls for an overt response on the part of the learner.

Suppes' (1964) suggested that latency may be more sensitive than errors in revealing mastery and depth and thus be an excellent learning criterion. Latency has the advantages of providing a trial-to-trial measure of learner performance and of always being available. Error rate, for example, is only available when the learner is forced into making an overt response. Time data exist whether the learner responds overtly or covertly (thinks his answer).

According to Brooks (1961), when both error rate and latency are available for individuals, they are likely to be significantly correlated with one another. Brooks further pointed out that time data, although having the advantage of being recorded automatically, have limitations in their usefulness. The correlation of time data with other variables relating to the quality of student learning is poorly understood (Brooks and Clark, 1969).

Time data were used in a study involving individually prescribed instruction (IPI) by Yeager and Kissel (1969). It was found that the number of days required to master a given unit in mathematics was related to the learner's initial entering state. The most important factors of initial learner state were the learner's pre-test score, number of skills to master, and learner's age.

In a study by Dick and Latta (1969) comparing the effects of ability and mode of instruction (CAI and PI), it was found that low ability students spent increasing time in the actual production of correct answers but did not perform significantly better. Low ability students spent more time on CAI, made significantly more errors, and had significantly lower terminal-test performance as compared to low ability students using programmed instruction.

Brooks and Clark (1969) conducted a study with junior-college students. The students were given a test, and latency data were recorded for each item. Each student then reviewed test items selected on the basis of the time he had spent responding to the items. The students were divided into two groups for the study. One group reviewed items they had answered slowly. For each student, slow answering on each item was defined as responding in more than his own median time for all test items. The other group reviewed their quickly answered items. When retested, the students who had reviewed their slowly answered items made fewer errors on the re-test. They also showed a significantly greater reduction in percentage of errors from first to second re-test.

In replication studies by Brooks, Clark, and Brown (1969) dealing with learning as a function of the relationship between student response time and difficulty of instructional items, it was found that subjects made fewer post-test errors when spending more response time on difficult (relative to easy) instructional items. It was proposed that learning may be increased by causing students to change the distribution of time on learning tasks by causing them to better match time spent with task difficulty.

These studies tend to support the idea that time spent on learning is an interesting variable which needs further study. The extent to which this variable correlates with student entering ability, error rate, and general abilities may be of special value when attempting to provide for individual differences among learners.

Purpose

This report describes inter-correlations for the general abilities of intelligence and reading, specific ISCS achievement in terms of both frame

responses and post instruction achievement test scores, and latency. The purpose of this study is to examine the relative extent to which latency, and quantities derived from it, can be used to predict achievement.

Procedure

Twenty seventh-grade students were selected from the Florida State University School to participate in the ISCS CAI classroom for the 1968-69 school year. These students were selected to provide subjects of a broad range of abilities. The California Test of Mental Maturity (CTMM, Level 3) and the Metropolitan Achievement Test of Reading (MAT Reading, Form AM) were administered to the group selected. The Alternate (Form BM) of the MAT Reading test and the ISCS science achievement test (1968 experimental edition) were administered to the same students as post-tests. The raw score means and standard deviations for the students on these tests are shown in Table I. No claim is made that the distribution of the 20 scores is normal.

CHARACTERISTICS OF THE ISCS-CAI STUDENT GROUPS

TEST	MEAN	s.d.	RANGE	N
CTMM	78.05	10.65	61-98	20
MAT READING (pre-test)	29.75	7.52	10-41	20
MAT READING (post-test)	30.11	5.70	15-36	18
ISCS ACHIEVEMENT	27.55	5.29	18-38	20

TABLE I

Twenty-two chapters of ISCS seventh-grade core materials were programmed. From these materials, four chapters were selected. The criteria for selections were:

1. Sampling of student behavior over time.
2. Sampling of chapters which contained material representative of a variety of frame types.

The four types of CAI frames selected were:

1. Text material preceded and followed by frames of the same type.
2. Questions which require answers directly related to text frames.
3. Activity frames where student latency included time to complete specified activities.
4. Text material containing a rhetorical question.

Ten students were randomly selected from the group of twenty students in the class. The means, standard deviation, and standard errors of measurement for the sample are shown in Table II. Using the "t" test, with finite population correction, no significant differences were found at the .05 confidence level between the standardized test mean scores for this sample and those of the population reported in Table I.

DESCRIPTIVE STATISTICS OF THE TEN CAI STUDENT SAMPLES

TEST	MEAN	s.d.	SE_M
CTMM	74.7	11.17	3.53
MAT READING (pre-test)	27.8	7.30	2.31
MAT READING (post-test)	27.1	6.03	1.91
ISCS ACHIEVEMENT	26.8	6.47	2.05

TABLE II

For purposes of this study, it was felt that the mean latency per word of text would be a useful means of treating variations in frame length. Word-rate, as used in this study, is defined as the ratio of the number of words per frame to the latency for that frame and is expressed in units of words per minute. With such a measure, it becomes possible to determine readily the general reading rate for each individual student and to notice any deviations from that rate. Further, the relation of such deviations to frame responses and general course achievement can be readily examined.

The procedure used to get these word-rate data began by identifying the particular frames for which latency was not likely affected by student reaction to an adjacent frame i.e., only those frames which required no response such as carrying out instructions or answering questions. Once identified, the frame latencies were extracted for each student using analysis programs developed by ISCS (Teates, et al., 1970). The word counts for each frame were determined and the word rates correlated. In all, 43 frames were selected from Chapters 3, 10, 15, and 19 for text frames. The number of rhetorical question frames selected for word-rate calculations was nine. Because rhetorical question frames were not used in Chapters 15 and 19, Chapter 8 frames were substituted to add to those from Chapters 3 and 10.

Results and Discussion

All examination of student word-rate response for the frames selected showed considerable variability of word rate around the student's mean word rate within each chapter. Furthermore, consistent large variability was observed for certain students but not for others. For purposes of analysis, a derived variable was calculated for each student as a potential correlate of his performance. This variable, which can be thought of as word rate stability, is defined as:

$$\text{Word rate stability} = \frac{\sum^{7} \left|(\text{frame word rate} - \text{mean word rate})\right|}{\text{Number of Frames}}$$

Note the WR stability is always a positive quantity by this definition as it is defined as the average absolute magnitude of the difference between the word rate of a student on a particular frame less his average word rate for all frames.

Because data for a small sample number of CAI students were used in this study and because no assumption of normality is claimed regarding the distribution of test scores for these students, the Spearman Rank Order correlation was selected to estimate the inter-relationship of achievement, ability, and CAI variables. The eleven variables used were:

1. General intelligence as measured by the CTMM, Level 3.

2. Entering reading ability as measured by the MAT Reading Test, form AM.

3. End of course reading ability as measured by the MAT Reading Test, form BM.

4. End of course science achievement as measured by the ISCS achievement test.

5. Word rate as measured in Chapters 3, 10, 15, and 19. This word rate is the mean rate for all four chapters expressed in words/second.

6. Total time or latency in Chapters 3, 10, 15, and 19 combined expressed in minutes.

7. Word rate stability within Chapters 3, 10, 15, and 19. This is the quantity which is really the unsigned accumulation of all the deviations from the mean word rate for each frame.

8. Total time or latency in Activity Frames for Chapters 3, 8, 10, and 19 combined expressed in minutes. This measure includes all time expended in reading the instructions and carrying out the laboratory activities.

9. Word rate for rhetorical question text frames for Chapters 3, 8, and 10 expressed in words/sec.

10. Total time or latency in responding to questions in Chapters 3, 8, 10, and 19 expressed in minutes.

11. Number of correct responses to questions in Chapters 3, 8, 10, and 19.

The correlation matrix for these eleven variables is given in Table III below. Appendix 1 lists the values of each of these variables for each student.

Spearman Rank Inter-Correlations of Achievement, Ability, and CAI Variables

Variable		1	2	3	4	5	6	7	8	9	10
1	CTMM	0.000									
2	Reading (pre-test)	.655*	0.000								
3	Reading (post-test)	.497	.806**	0.000							
4	ISCS Ach.	.752*	.624	.479	0.000						
5	Word Rate for Text	-.736*	-.824**	-.824**	-.700*	0.000					
6	Total Time in Ch.	.342	.194	.624	.439*	-.576	0.000				
7	Word Rate Stability	-.773**	-.667*	-.758**	-.785**	.867**	-.758*	0.000			
8	Activity Frame Time	-.045	-.491	-.155	-.155	.079	.358	.018	0.000		
9	W. R. for Rhet. Qu.	-.455	-.391	-.552	-.585	.630*	-.803**	.785**	.033	0.000	
10	Qu. Response Time	.009	.091	.455	.221	-.430	.794**	-.503	.176	-.688*	0.000
11	No Correct Qu. Resp.	.070	.130	.327	.442	-.079	.491*	-.255	-.133	-.503	.327

* sig at .05 level

** sig at .01 level

TABLE III

Eighteen statistically significant relationships appear in this matrix. Fifteen of these relationships directly involve the word rate in text material, word rate for rhetorical questions, and word rate stability measures. The other three correlations are for pre- and post-test MAT reading (.806), CTMM with pre-test reading (.655), and CTMM with ISCS achievement (.752).

The word rate and word rate stability measures have higher correlations (-.700 and -.785) with ISCS achievement than either MAT reading pre- or post-test (.624 and .479). The reduction in reading correlation from pre- to post-test may be interpreted in the light of studies that have consistently suggested that reading ability of seventh-grade ISCS students has improved 10 to 12 percentile rank points over and above maturation (ISCS, 1970). The thesis is that, as the student's general reading skills improve, his science achievement becomes less predictable by these skills. The students' rank order of improvement in reading differs from that of their science achievement. This is further supported by the reduction in reading pre- and post-test correlations with general intelligence (.655 and .497) and both the previously mentioned high correlations of both intelligence with ISCS achievement and pre- and post-test reading intercorrelation.

Word-rate highly correlates with the general reading skills (-.824 and -.824) as does the word rate stability (-.667 and -.758). These measures exhibit consistent significant correlations as the students progress through the course as is shown in Table IV. They also retain high correlations to general intelligence (-.736 and -.773). Interpretations of these correlations support the thesis that both word rate and word rate stability do serve the role of a significant measure of reading behavior and are important predictors of content achievement.

CORRELATIONS OF WORD RATE AND WORD RATE STABILITY
WITH ISCS ACHIEVEMENT BY CHAPTER

	Ch. 3	Ch. 10	Ch. 15	Ch. 19
Word Rate	-.348	-.670	-.758	-.645
Word Rate Stability	-.482	-.785	-.785	-.682

TABLE IV

The negative sign associated with both the word rate and word rate stability measure correlations requires explanation. One might suspect that the higher achiever reads more slowly but at a more uniform rate. Such an interpretation is misleading. The data do suggest that the student who progresses at a uniform reading rate has high intelligence and attains a higher ISCS achievement test score than the student with an erratic reading rate. However, the high mean word rate of the low achiever may result from his skipping through the reading passages, thus not reading them at all. This interpretation also leads one to suspect that the poor reader could be expected to complete each chapter (and thus the course) before the high achiever. The correlation of total time in chapters with word rate (-.576) supports this. However, the positive correlation (.358) of word rate with activity frame time suggests that the poor reader also takes longer to carry out the instructions he was meant to read in the frame, thereby retarding his rate of progress through the curriculum material. Conversly, the poor reader tends to take less time to respond to chapter questions ($r = -.43$), and has less success in answering them ($r = -.503$).

Multiple correlations between the criterion ISCS Achievement test scores and the word rate, reading and intelligence measures were computed by means of step wise regression. The coefficients are listed in Table V and were obtained by combining the test scores in the order of their contribution.

Table VI lists similar coefficients which were obtained when the regression was determined using word rate stability in lieu of the word rate data. The stepwise regression computer program (BMD02R) contained in the BMD Computer Program Manual (University of California Press, 1967) was in the computations.

SUMMARY TABLE
MULTIPLE REGRESSION ANALYSIS
USING WORD RATE

Step Number	Variable Entered	Multiple R	R^2	Increase in R^2	F Value	No. of Dep. Var. incl.
1	CTMM	.6981	.4873	.4873	7.6042	1
2	Word Rate	.7875	.6202	.1328	2.4479	2
3	Reading (pre)	.7924	.6279	.0077	.1248	3
4	Reading (post)	.7949	.6316	.0037	.0499	4

TABLE V

SUMMARY TABLE
MULTIPLE REGRESSION ANALYSIS
USING WORD RATE STABILITY

Step Number	Variable Entered	Multiple R	R^2	Increase in R^2	F Value	No. of Dep. Var. incl.
1	CTMM	.6981	.4873	.4873	7.6042	1
2	WR Stability	.7947	.6315	.1442	2.7385	2
3	Reading (pre)	.7980	.6368	.0054	.0886	3
4	Reading (post)	F-level insufficient for computation				

TABLE VI

Tables V and VI show that General Intelligence makes most significant contribution to the regression equation, followed by the word rate or word rate stability measures to account for better than 62% of the variance in the criterion achievement test scores. The contribution of the reading test scores in both instances is relatively small as predictor variables.

Rhetorical question frames were employed by the ISCS authors for the purpose of focusing student attention and provoking thought. Word rates were calculated for such frames in Chapters 3, 10, and 19 and found to exhibit significant correlations with the text materials word rate (.63), total time in chapter (-.803), and word rate stability (.785). In addition, these were moderate, but not significant, correlations with both ISCS achievement (-.585) and the number of correct question responses (-.503).

Summary

This study gives strong evidence that word rate and word rate stability as measures of reading behavior predict science achievement with greater efficiency than the MAT general reading tests. Further, the predictive efficiency remains high throughout the course in contrast to the standardized reading test which loses predictive power as the course progresses. To the extent that the ISCS achievement test or the student's responses to chapter questions can be regarded a valid criterion measure, the word rate measure appears to have more predictive power than latency alone as suggested by Suppes (1964).

The findings reported in this study are consistent with the statement of Brooks and Clark (1969) that correlation of time data with other variables relating to quality of learning is poorly understood. Word-rate and stability measures may measure students' involvement with or tracking of the printed

word, and as such be related to the quality of communication between the author and learner. To the extent this is true, the CAI word rate measures can prove to be invaluable tools in the formative evaluation of curriculum materials. This matter deserves further research.

APPENDIX A

Data Listing for Eleven Variables on 10 CAI Students

Data Listing for Eleven Variables
on 10 CAI Students

Student ID No.	CIMM	MAT Reading (pre)	MAT Reading (post)	ISCS Achievement	Word Rate (Sum of 4 Chapters) x 10^{-1}	Time in Chapter (Sum of 4 Chapters)	Word Stability (Sum of 4 Chapters) x 10^{-1}	Activity Frame Time (Sum of 4 Chapters)	Word Rate for Rhetorical Questions (Sum of 4 Chapters) x 10^{-1}	Chapters Question Response Time (Sum of 3 Chapters)	No. of Correct Responses to Chapter Questions (Sum of 3 Chapters)
752	72	28	29	25	101	625	59	208	14	151	19
755	61	30	30	21	198	508	198	151	19	64	25
756	96	33	32	30	64	620	29	168	19	54	18
759	71	22	18	21	529	414	406	235	132	37	15
760	63	10	15	18	707	454	618	194	112	25	18
761	78	26	28	31	162	821	32	185	8	72	25
762	75	31	26	34	153	409	86	127	29	33	19
764	63	30	29	22	115	609	57	159	17	136	17
766	85	35	30	28	98	486	45	138	13	52	18
768	83	33	34	38	43	974	25	212	11	70	24
Mean	74.7	27.8	27.1	26.8	217	592	155.5	177.7	37.4	69.4	19.8
s.d.	11.2	7.3	6.0	6.5	209	588	190.5	35.0	45.2	40	11.36
SE_M	3.5	2.3	1.9	7.1	66.1	185.9	60.2	11.1	14.3	12.7	3.6

APPENDIX B

Data Listing of Twenty Six Variables on 10 CAI Students

APPENDIX B

Data Listing of Twenty Six Variables on 10 CAI Students

Variable No.	Description	Student No.									
		752	755	756	759	760	761	762	764	766	768
1	CTMM	72	61	96	71	63	78	75	63	85	83
2	MAT Reading (pre)	28	30	33	22	10	26	31	30	35	33
3	MAT Reading (post)	29	30	32	18	15	28	26	29	30	34
4	ISCS Achievement	25	21	30	21	18	31	34	22	28	38
5	Word Rate, Ch. 3*	16	92	13	34	55	114	53	19	23	12
6	Word Rate, Ch. 10 *	33	17	16	180	242	28	22	32	38	6
7	Word Rate, Ch. 15 *	33	47	16	25	120	10	32	38	20	12
8	Word Rate, Ch. 19 *	14	42	19	290	290	10	46	26	17	13
9	Time in Ch. 3	148	256	249	176	247	300	134	171	195	509
10	Time in Ch. 10	168	134	157	124	60	176	127	253	120	247
11	Time in Ch. 15	68	18	60	29	29	111	32	64	56	50
12	Time in Ch. 19	246	100	154	85	118	234	116	121	115	168
13	W.R. Stability, Ch. 3*	4	119	7	27	105	8	41	10	13	9
14	W.R. Stability, Ch. 10*	16	7	6	150	170	11	4	14	15	3
15	W.R. Stability, Ch. 15*	34	49	10	35	172	9	13	31	9	10
16	W.R. Stability, Ch. 19*	5	23	6	194	171	4	28	2	8	3
17	Activity Frame Time	208	151	168	235	194	185	127	159	138	312
18	W.R. in Rhetorical Qu.*	14	19	19	132	112	8	29	17	13	11
19	Qu. Response Time, Ch. 3	36	20	27	19	12	15	12	18	19	34
20	Qu. Response Time, Ch. 8	39	29	36	10	10	41	18	53	62	22
21	Qu. Response Time, Ch. 10	61	20	18	14	4	21	14	110	17	11
22	Qu. Response Time, Ch. 19	54	24	9	4	9	36	7	8	16	25
23	Correct Responses, Ch. 3	10	10	11	5	8	9	6	7	8	10
24	Correct Responses, Ch. 8	12	14	10	9	7	10	11	3	13	11
25	Correct Responses, Ch. 10	6	10	6	4	6	12	9	7	7	10
26	Correct Responses, Ch. 19	3	5	1	6	4	4	4	3	3	4

* x 10^{-1}

APPENDIX C

Spearman Rank Order Correlation Matrix
of
Intelligence, Ability and Achievement Variables
with
CAI Variables by Chapter

Appendix C

Spearman Rank Order Correlation Matrix
of
Intelligence, Ability and Achievement Variables
with
CAI Variables by Chapter
N = 10 Subjects

	Variable	1	2	3	4	5	6	7	8	9
1	CIMM	0.000	.655	.497	.752	-.476	-.355	-.809	-.561	.221
2	MAT Reading (pre)		0.000	.806	.624	-.533	-.582	-.406	-.379	.109
3	MAT Reading (post)			0.000	.479	-.600	-.727	-.397	-.585	.473
4	ISCS Achievement				0.000	-.348	-.670	-.758	-.645	.191
5	Word Rate, Ch. 3					0.000	.321	.258	.300	.067
6	Word Rate, Ch. 10						0.000	.439	.452	-.455
7	Word Rate, Ch. 15							0.000	.667	-.445
8	Word Rate, Ch. 19								0.000	-.427
9	Time in Ch. 3									0.000

Appendix C (cont.)

	Variable	10	11	12	13	14	15	16	17	18
1	CTMM	.088	.464	.355	-.597	-.415	-.833	-.258	-.045	-.455
2	MAT Reading (pre)	.182	.136	.018	-.200	-.655	-.618	-.345	-.491	-.391
3	MAT Reading (post)	.473	.203	.261	-.388	-.624	-.458	-.570	-.115	-.552
4	ISCS Achievement	.458	.452	.476	-.482	-.785	-.785	-.482	-.155	-.585
5	Word Rate, Ch. 3	-.382	-.270	-.358	.588	.261	.242	.442	-.285	.197
6	Word Rate, Ch. 10	-.588	-.094	-.297	.248	.952	.388	.479	.188	.379
7	Word Rate, Ch. 15	-.348	-.473	-.330	.567	.482	.870	.391	-.148	.588
8	Word Rate, Ch. 19	-.633	-.745	-.742	.748	.391	.742	.791	-.082	.964
9	Time in Ch. 3	.212	-.052	.176	-.055	-.333	-.248	-.261	.261	-.433
10	Time in Ch. 10	0.000	.615	.648	-.600	-.491	-.321	-.903	.152	-.603
11	Time in Ch. 15		0.000	.797	-.864	-.058	-.615	-.736	.039	-.685
12	Time in Ch. 19			0.000	-.818	-.200	-.358	-.721	.285	-.639
13	W.R. Stability, Ch. 3				0.000	.139	.552	.661	-.333	.591
14	W.R. Stability, Ch. 10					0.000	.485	.406	.333	.355
15	W.R. Stability, Ch. 15						0.000	.521	.255	.733
16	W.R. Stability, Ch. 19							0.000	-.018	.809
17	Activity Frame Time								0.000	.033
18	W.R. in Rhetorical Qu.									0.000

Appendix C (cont.)

	Variable	19	20	21	22	23	24	25	26
1	CIMM	-.639	.018	-.415	-.833	-.400	.673	-.052	.294
2	MAT Reading (pre)	-.242	-.112	-.655	-.618	-.388	.542	-.488	.285
3	MAT Reading (post)	-.418	.309	-.624	-.458	-.485	.185	-.100	.055
4	ISCS Achievement	-.558	.064	-.785	-.785	-.400	.515	-.161	.082
5	Word Rate, Ch. 3	.603	.142	.261	.242	.558	-.142	-.252	-.418
6	Word Rate, Ch. 10	.361	-.403	.952	.388	.491	-.118	.173	.224
7	Word Rate, Ch. 15	.733	-.303	.482	.870	.567	-.406	-.136	-.027
8	Word Rate, Ch. 19	.836	-.224	.391	.742	.888	-.191	-.073	-.076
9	Time in Ch. 3	-.191	.833	-.333	-.248	-.073	-.342	.294	-.624
10	Time in Ch. 10	-.567	.106	-.491	-.321	-.485	-.209	.124	.188
11	Time in Ch. 15	-.764	-.279	-.058	-.615	-.615	.252	0.000	.603
12	Time in Ch. 19	-.742	.021	-.200	-.358	-.521	-.027	.264	.200
19	Qu. Response Time, Ch. 3	0.000	-.045	.282	.688	.833	-.209	-.282	-.300
20	Qu. Response Time, Ch. 8		0.000	-.252	.055	.221	-.267	.524	-.785
21	Qu. Response Time, Ch. 10			0.000	.485	.442	-.239	.324	.188
22	Qu. Response Time, Ch. 19				0.000	.758	-.539	.276	-.279
23	Correct Responses, Ch. 3					0.000	-.085	.252	-.279
24	Correct Responses, Ch. 8						0.000	-.379	.427
25	Correct Responses, Ch. 10							0.000	-.288
26	Correct Responses, Ch. 19								0.000

APPENDIX D

References

Appendix D

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